Name Per: Date:

Density Worksheet

Chemistry in Context 2008-9

Perhaps someone has tried to trick you with this question: "Which is heavier, a pound of lead or a pound of feathers?" Many people would instinctively answer "lead." When they give this incorrect answer, these people are really thinking of density. If a piece of lead and a feather of the same volume are weighed, the lead would have a greater mass than the feather. It would take a much larger volume of feathers to equal the mass of a given volume of lead.

Density is the relationship of the mass of an object to its volume. Density is usually reported in units of grams per cubic centimeter (g/cm^3). For example, water has a density of 1.00 g/cm^3. Since a cubic centimeter contains the same volume as a milliliter, in some cases you may see density expressed as g/mL.

$$\text{Density} = \frac{\text{mass}}{\text{volume}} \quad \text{or} \quad D = \frac{M}{V}$$

To solve density problems, list the known and unknown values, then use one of the following.

- When a problem requires you to calculate density, use the density equation, $\boxed{D = \frac{M}{V}}$
- You can solve for mass by multiplying both sides of the density equation by volume.

$$D\,V = \frac{M\cancel{V}}{\cancel{V}} \quad \text{or} \quad \boxed{M = D\,V}$$

- You can solve for volume by dividing both sides of the equation above by density.

$$\frac{M}{D} = \frac{\cancel{D}V}{\cancel{D}} \quad \text{or} \quad \boxed{V = \frac{M}{D}}$$

Example: What is the mass of an object that has a density of 8 g/cm^3 and a volume of 64 cm^3?

Known:	$D = 8\ g/cm^3$
	$V = 64\ cm^3$
Unknown:	$M = ?$
Equation to use:	$M = D\,V$
"Plug and chug":	$M = (8\ g/cm^3)(64\ cm^3) = 512\ g$

PROBLEMS List the known and unknown values; try to derive the equation without looking above.

1. A piece of tin has a mass of 16.52 g and a volume of 2.26 cm^3. What is the density of tin?

   Known: mass = 16.52g volume = $2.26\ cm^3$ $D = \frac{m}{V}$

   Unknown: Density (3SF) 7.309734513

   $\frac{16.52g}{2.26cm^3} = \boxed{7.31\ g/cm^3}$

2. A man has a 50.0 cm^3 bottle completely filled with 163 g of a slimy green liquid. What is the density of the liquid?

   Known: volume = $50.0\ cm^3$ mass = 163g $D = \frac{m}{V}$

   Unknown: Density (3SF)

   $\frac{163g}{50.0cm^3} = \boxed{3.26\ \frac{g}{cm^3}}$

3. A sealed 2500 cm^3 flask is full to capacity with 0.36 g of a substance. Determine the density of the substance. Guess if the substance is a gas, a liquid, or a solid.

Known: volume = 2500 cm^3 mass = 0.36g $D = \frac{m}{V}$ $\frac{0.36g}{2500cm^3} = 1.4 \times 10^{-4}\ g/cm^3$

Unknown: Density (2SF)

4. Different kinds of wood have different densities. The density of oak wood is generally 0.7 g/cm^3. If a 35 cm^3 piece of wood has a mass of 25 g, is the wood likely to be oak?

Known: mass = 25g volume = 35 cm^3 $D = \frac{m}{V}$ $\frac{25g}{35cm^3} = 0.714285714 \rightarrow 0.71\ g/cm^3$

Unknown: Density (2SF), Is the piece oak? YES

5. The density of pine is generally about 0.5 g/cm^3. What is the mass of a 800 cm^3 piece of pine?

Known: Density = 0.5 g/cm^3 volume = 800 cm^3

Unknown: Mass (1SF) $D = \frac{m}{V}$ $m = DV$ $\frac{0.5g}{cm^3} \times 800cm^3 = 400g$

6. What is the volume of 325 g of metal with a density of 9.0 g/cm^3?

Known: mass = 325g Density = 9.0 g/cm^3

Unknown: volume (2SF) $D = \frac{m}{V}$ $V = \frac{m}{D}$ $325g \cdot \frac{cm^3}{9.0g} = 36.1 \rightarrow 36\ cm^3$

7. Diamonds have a density of 3.5 g/cm^3. How big is a diamond that has a mass of 0.10 g?

Known: density = 3.5 g/cm^3 mass = 0.10g

Unknown: volume (2SF) $D = \frac{m}{V}$ $V = \frac{m}{D}$ $0.10g \times \frac{cm^3}{3.5g} = 0.028571429 \rightarrow 0.029\ cm^3$

8. What mass of water in grams will fill a tank 100 cm long, 50 cm wide, and 30 cm high?

Known: Density = 1.0 g/cm^3 L = 100cm W = 30cm H = 30cm

Unknown: volume, mass $V = L \times W \times h$ $D = \frac{m}{V}$ $m = DV$

$m = D \times L \times W \times h$ $1.0\ g/cm^3 \times 100cm \times 50cm \times 30cm = 150000 \rightarrow 200000\ g$

9. A graduated cylinder is filled with water to a level of 40.0 mL. When a piece of copper is lowered into the cylinder, the water level rises to 63.4 mL. Find the volume of the copper sample. If the density of the copper is 8.9 g/cm^3, what is its mass?

Known: initial and final volume 40.0mL and 63.4mL, Density 8.9 g/cm^3 ($1cm^3 = 1mL$)

Unknown: volume, mass (2SF)

$V = V_f - V_i$ $m = DV$ $m = D(V_f - V_i)$

$8.9\frac{g}{cm^3} \frac{(63.4cm^3 - 40.8cm^3)}{1} = 208.26 \rightarrow 210\ g$

SCIENTIFIC NOTATION
PROGRAMMED INSTRUCTION

Worksheet #4 Name _____

Objective: Convert exponential notation to proper scientific notation.

Example: $623 \times 10^{-6} = 6.23 \times 10^{-4}$ (notice that the decimal point is not in the correct place in the first value...this is not proper scientific notation)

STEPS:

1) Move the decimal point to the "proper" place. (Between the first and second digit.)
   Example: Move it from 623 to 6.23
2) Did the value of the number increase or decrease?
   Example: When you changed 623 to 6.23, you decreased the number's value.
3) Change the exponent the correct amount and in the correct direction so that it "cancels" the change in the number's value. (When the number value is increased (decimal point moved to the right) the the exponent must be decreased. When the number value is decreased the exponent must be increased.)
   Example: 623 was decreased to 6.23, therefore the exponent must be increased from -6 to -4. (Be careful of negative numbers!!!)

A) Convert the following numbers from exponential notation to proper scientific notation:

1) $65. \times 10^{-4}$ 6.5×10^{-3}

2) 0.062×10^{6} 6.2×10^{4}

3) $0.009\,56 \times 10^{5}$ 9.56×10^{2}

4) 0.32×10^{-2} 3.2×10^{-3}

5) 0.63×10^{-2} 6.3×10^{-3}

6) 18.3×10^{12} 1.83×10^{13}

7) 81×10^{7} 8.1×10^{8}

8) 23.7×10^{-1} 2.37×10^{0}

9) $300. \times 10^{8}$ 3.00×10^{10}

10) $0.008\,72 \times 10^{-3}$ 8.72×10^{-6}

SCIENTIFIC NOTATION
PROGRAMMED INSTRUCTION

Worksheet #5 Name _____

Objective: Multiply scientific notation
Example: $7.3 \times 10^3 \times 2.0 \times 10^6$

STEPS:

1) To find the "number part" of the answer, multiply the numbers of the problem.
Example: 7.3 x 2.0 = 14.6

2) To find the exponent of the answer, add the exponents from the problem.
(Be careful of negative numbers!!)
Example: -3 + 6 = 3

3) Check that the answer is **proper** scientific notation and change it if necessary. (The "number part" must be equal to or greater than 1 & less than 10.)
Example: 14.6×10^3 is not proper scientific notation so it should be changed to 1.46×10^4.

A) Convert the following numbers from conventional notation to scientific notation:

1) $7.3 \times 10^3 \times 2.0 \times 10^6$
1.46×10^{10}

2) $4.2 \times 10^{-3} \times 6.0 \times 10^{23}$
252×10^{21}

3) $6.9 \times 10^{-5} \times 1.1 \times 10^7$
7.59×10^{2}

4) $7.0 \times 10^7 \times 3.2 \times 10^{-11}$
2.24×10^{-3}

5) $2.3 \times 10^{-3} \times 2.0 \times 10^{-6}$
4.6×10^{-9}

6) $1.3 \times 10^2 \times 4.8 \times 10^9$
6.24×10^{11}

7) $3.7 \times 10^{13} \times 5.0 \times 10^{10}$
1.85×10^{24}

8) $2.9 \times 10^3 \times 2.0 \times 10^3$
5.8×10^{6}

9) $8.3 \times 10^4 \times 6.88 \times 10^{-6}$
5.7104×10^{-1}

10) $3.1 \times 10^{11} \times 6.02 \times 10^{23}$
1.8662×10^{35}

SCIENTIFIC NOTATION
PROGRAMMED INSTRUCTION

Worksheet #6 Name _____

Objective: Divide scientific notation
Example: $7.3 \times 10^{-3} \div 8.0 \times 10^{6}$

STEPS:

1) To find the "number part" of the answer, divide the numbers of the problem.
Example: 7.3 ÷ 2.0 = 0.91 (follow significant digits rules)

2) To find the exponent of the answer, subtract the exponents from the problem in the order they are given. (Be careful of negative numbers!!)
Example: -3 - 6 = -9

3) Check that the answer is **proper** scientific notation and change it if necessary. (The "number part" must be equal to or greater than 1 & less than 10.)
Example: 0.91×10^{9} is not proper scientific notation so it should be changed to 9.1×10^{10}.

A) Convert the following numbers from conventional notation to scientific notation:

1) $7.3 \times 10^{3} \div 2.0 \times 10^{6}$
$3.65 \times 10^{-3} \rightarrow 3.7 \times 10^{-3}$

2) $4.2 \times 10^{-3} \div 6.0 \times 10^{23}$
$7 \times 10^{-27} \rightarrow 7.0 \times 10^{-27}$

3) $6.9 \times 10^{-5} \div 1.1 \times 10^{7}$
$6.27272727 \times 10^{-12} \rightarrow 6.3 \times 10^{-12}$

4) $7.0 \times 10^{7} \div 3.2 \times 10^{-11}$
$2.1875 \times 10^{18} \rightarrow 2.2 \times 10^{18}$

5) $2.3 \times 10^{-3} \div 2.0 \times 10^{-6}$
$1.15 \times 10^{3} \rightarrow 1.2 \times 10^{3}$

6) $1.3 \times 10^{2} \div 4.8 \times 10^{9}$
$2.708333333 \times 10^{-8}$ 2.7×10^{-8}

7) $3.7 \times 10^{13} \div 5.0 \times 10^{10}$
7.5×10^{2}
4

8) $2.9 \times 10^{3} \div 2.0 \times 10^{3}$
$1.45 \times 10^{0} \rightarrow 1.5 \times 10^{0}$

9) $8.3 \times 10^{4} \div 6.88 \times 10^{-6}$
$1.206395349 \times 10^{10}$
$\rightarrow 1.2 \times 10^{10}$

10) $3.1 \times 10^{11} \div 6.02 \times 10^{23}$
$5.14950166 \times 10^{-13} \rightarrow 5.1 \times 10^{-13}$

SCIENTIFIC NOTATION
PROGRAMMED INSTRUCTION

Worksheet #7 Name _____

Objective: Add or subtract scientific notation

Example: $7.3 \times 10^3 + 2.0 \times 10^2 = 7.5 \times 10^3$

STEPS:

1) Change the smaller exponent to be the same value as the larger. (Remember to also move the decimal point.)

Example: 2.0×10^{-2} should be changed to 0.20×10^{-3}

2) To find the number part, add the numbers (or subtract them in a subtraction problem).

Example: 7.3 + 0.20 = 7.5 (Follow significant digit rules.)

3) The exponent of the answer is the same as the exponents in the problem.

Example: The answer is also x 10^{-3}

4) Check to see that the answer is in **proper** scientific notation and change it, if not. (It probably is *if* you changed the small exponent to the larger exponent.)

A) Convert the following numbers from conventional notation to scientific notation:

1) $7.3 \times 10^3 + 2.0 \times 10^4$

$2.73 \times 10^4 \rightarrow 7.7 \times 10^4$

2) $4.2 \times 10^{24} - 6.0 \times 10^{23}$

3.6×10^{24}

3) $6.9 \times 10^{-6} + 1.1 \times 10^{-7}$

$7.01 \times 10^{-6} \rightarrow 7.0 \times 10^{-6}$

4) $7.0 \times 10^{-12} - 3.2 \times 10^{-11}$

-2.5×10^{-11}

5) $2.3 \times 10^7 + 2.0 \times 10^6$

2.5×10^7

6) $1.3 \times 10^{10} - 4.8 \times 10^9$

8.2×10^9

7) $3.70 \times 10^{13} + 5.20 \times 10^{11}$

$3.752 \times 10^{13} \rightarrow 3.75 \times 10^{13}$

8) $2.9 \times 10^3 - 2.0 \times 10^3$

$9 \times 10^2 \rightarrow 9.0 \times 10^2$

9) $8.304 \times 10^4 + 6.88 \times 10^6$

$6.96304 \times 10^6 \rightarrow 6.96 \times 10^6$

10) $3.10 \times 10^{11} - 6.02 \times 10^9$

$3.0398 \times 10^{11} \rightarrow 3.10 \times 10^{11}$

Scientific Notation Practice

Section A: The Definition of the Notation (Decimal => Scientific)

Write the following numbers in *scientific notation.*

1. 1001 1.001×10^{3}
2. 53 5.3×10^{1}
3. 6,926,300,000 $6.926300000 \times 10^{9}$
4. -392 -3.92×10^{2}
5. 0.00361 3.61×10^{-3}
6. 0.13592 1.3592×10^{-1}
7. -0.0038 -3.8×10^{-3}
8. 0.00000013 1.3×10^{-7}
9. -0.567 -5.67×10^{-1}

Section B: Converting Back (Scientific => Decimal)

1. 1.92×10^{3} 0.00192
2. 3.051×10^{1} 30.51
3. -4.29×10^{2} -429
4. 6.251×10^{9} 6251000000
5. 8.317×10^{6} 8317000
6. 1.03×10^{-2} 0.0103
7. 8.862×10^{-1} 0.8862
8. 9.512×10^{-8} 0.000000009512
9. -6.5×10^{-3} -0.0065
10. 3.159×10^{2} 315.9

Section C: Multiplication, Division and ... with Scientific Notation

Use Scientific Notation (and only the scientific notation!) to find the answer to the following multiplications, divisions, additions and subtractions. SIG FIGS!!!

1. $(4.1357 \times 10^{-15})(5.4 \times 10^{2}) =$ $22.33278 \times 10^{-13} \rightarrow 2.2 \times 10^{-12}$
2. $(4.367 \times 10^{5})(1.96 \times 10^{11}) =$ $8.55932 \times 10^{16} \rightarrow 8.56 \times 10^{16}$
3. $(1.695 \times 10^{4}) / (3.395 \times 10^{15}) =$ ~~5.754505×10~~ $0.4992623623 \times 10^{-11} \rightarrow 4.993 \times 10^{-12}$
4. $(6.97 \times 10^{3})/(2.34 \times 10^{-6}) =$ $2.978632479 \times 10^{9} \rightarrow 3.00 \times 10^{9}$
5. $5.16 \times 10^{-4} + 8.65 \times 10^{-5} =$ $6.025 \times 10^{-4} \rightarrow 6.03 \times 10^{-4}$
6. $9.68 \times 10^{4} + 6.97 \times 10^{3} =$ $10.377 \times 10^{4} \rightarrow 1.04 \times 10^{5}$
7. $3.2 \times 10^{-2} - 6.97 \times 10^{-3} =$ $2.803 \times 10^{-2} \rightarrow 2.8 \times 10^{-2}$
8. $4.367 \times 10^{5} - 1.695 \times 10^{4} =$ $4.1975 \times 10^{5} \rightarrow 4.198 \times 10^{5}$

Significant Figures Practice Worksheet

How many significant figures do the following numbers have?

1) 1234 4
2) 0.023 2
3) 890 2
4) 91010 4
5) 9010.0 5
6) 1090.0010 8
7) 0.00120 3
8) 3.4×10^{4} 2
9) 9.0×10^{-3} 2
10) 9.010×10^{-2} 4
11) 0.00030 2
12) 1020010 6
13) 780. 3
14) 1000 1
15) 918.010 6
16) 0.0001 1
17) 0.00390 3
18) 8120 3
19) 7.991×10^{-10} 4
20) 72 2

Significant Figures Worksheet

1. Determine the number of significant digits in each of the following:

a) 6.571 g 4	f) 30.07 g 4	k) 54.52 cm 4
b) 0.157 kg 3	g) 0.106 cm 3	l) 0.12090 mm 5
c) 28.0 ml 3	h) 0.0067 g 2	m) 2.690 g 4
d) 2500 m 2	i) 0.0230 cm 3	n) 43.07 cm 4
e) 0.0700000 g 6	j) 26.509 cm 5	

2. Add:
   a) 16.5 + 8 + 4.37 $28.87 \rightarrow 29$
   b) 13.25 + 10.00 + 9.6 $32.85 \rightarrow 32.9$
   c) 2.36 + 3.3810.355 + 1.06 $7.155 \rightarrow 7.16$
   d) 0.0853 + 0.0547 + 0.0370 + 0.00387 $0.18087 \rightarrow 0.1809$
   e) 25.37 + 6.850 + 15.07 + 8.056 $55.346 \rightarrow 55.35$

3. Subtract:
   a) 23.27 - 12.058 $11.212 \rightarrow 11.21$
   b) 13.57 - 6.3 $7.27 \rightarrow 7.3$
   c) 350.0 - 200 $150 \rightarrow 200$
   d) 27.68 - 14.369 $13.311 \rightarrow 13.31$

4. Multiply:
   a) 2.6 x 3.78 $9.828 \rightarrow 9.8$
   b) 6.54 x 0.37 $2.4198 \rightarrow 2.4$
   c) 3.15 x 2.5 x 4.00 $31.5 \rightarrow 32$
   d) 0.085 x 0.050 x 0.655 $0.00278375 \rightarrow 0.0028$
   e) 3.08 x 5.2 $16.016 \rightarrow 16$
   f) 0.0036 x 0.02 $0.000072 \rightarrow 0.00007$
   g) 4.35 x 2.74 x 3.008 $35.852352 \rightarrow 35.9$
   h) 35.7 x 0.78 x 2.3 $64.0458 \rightarrow 64$

5. Divide:
   a) 35 / 0.62 56
   b) 39 / 24.2 1.6
   c) 0.58 / 2.1 0.28
   d) 40.8 / 5.05 8.08
   e) 3.76 / 1.62 2.32
   f) 0.075 / 0.030 2.5

6. Express the Following in Scientific Notation:
   a) 0.000 03 3×10^{-5}
   b) 8 000 000 8×10^{6}
   c) 55 000 000 5.5×10^{7}
   d) 0.002 2×10^{-3}
   e) 0.000 007 7×10^{-6}
   f) 65 000 6.5×10^{4}

7. Do the Following Calculations Using Scientific Notation:
   a) 0.0005 x 0.002 $(5 \times 10^{-4})(2 \times 10^{-3}) = 10 \times 10^{-7} = 1 \times 10^{-6}$
   b) 5000 000 x 6000 $(5 \times 10^{6})(6 \times 10^{3}) = 30 \times 10^{9} = 3 \times 10^{10}$
   c) 65 000 x 0.003 $(6.5 \times 10^{4})(3 \times 10^{-3}) = 19.5 \times 10^{1} = 1.95 \times 10^{2} = 2 \times 10^{2}$
   d) 750 000 x 20 000 x 3000 $(7.5 \times 10^{5})(2 \times 10^{4}) = 15 \times 10^{9} = 1.5 \times 10^{10} = 2 \times 10^{2}$
   e) 9 000 / 300 $9 \times 10^{3} / 3 \times 10^{2} = 3 \times 10^{1}$
   f) 400 / 20 000 $4 \times 10^{2} / 2 \times 10^{4} = 2 \times 10^{-2}$
   g) 0.008 / 0.00002 $8 \times 10^{-3} / 2 \times 10^{-7} = 4 \times 10^{2}$
   h) (60 000 x 7000) / 1000 $(6 \times 10^{4})(7 \times 10^{3}) / 1 \times 10^{3} = 42 \times 10^{4} = 4.2 \times 10^{5} = 4 \times 10^{5}$
   i) (0.0006 x 0.002) / 0.0003 $(6 \times 10^{-4})(2 \times 10^{-3}) / 3 \times 10^{-4} = 4 \times 10^{-3}$
   j) (0.0006 x 8000) / 120 $(6 \times 10^{-4})(8 \times 10^{3}) / 1.2 \times 10^{2} = 40 \times 10^{-3} = 4 \times 10^{-2}$
   k) (400 000 x 0.0008 x 3 000) / (0.0002 x 0.0006) $((4 \times 10^{5})(8 \times 10^{-4})(3 \times 10^{3})) / ((2 \times 10^{-4})(6 \times 10^{-4})) = 8 \times 10^{12}$

K h da b d c m

Name Key
Date ____ Hour ____

Metric Conversion Worksheet

Convert the following. Write your answers in the spaces provided.

1. 256 m = 25600 cm
2. 97.25 cm = 972.5 mm
3. 952 g = 952000 mg
4. .574 m = 57.4 cm
5. 5.287 l = 5287 ml
6. 785.3 km = 785300 m
7. 84.363 km = 8436300 cm
8. 872 km = 872000000 mm
9. 95,824 cm = 958240 mm
10. 8.26 kl = 8260000 ml
11. 36 mm = 3.6 cm
12. 857 cm = 8570 mm
13. 8.52 mg = 0.00852 g
14. 975 mm = 97.5 cm
15. 9,824 cm = 98.24 m
16. 74.21 cm = 0.000742 l km
17. .254 g = 0.000254 kg
18. 96 mm = 0.000096 km
19. 12.5 cm = 0.125 m
20. 85 ml = 0.00085 l
21. 86 g = 86000 mg
22. 87.2 mm = 8.72 cm
23. 1 mm = 0.1 cm
24. 973.5 cm = 0.009735 km
25. .534 cm = 0.00534 m
26. 984 g = 0.984 kg
27. 8.64 m = 8640 mm
28. 64.3 ml = 0.0643 l
29. 8.47 km = 8470 m
30. 74,201 mm = 0.074201 km
31. .24 mg = 0.00000024 kg
32. 7.4 kl = 7400 l
33. 874 m = 87400 cm
34. 1 cm = 0.00001 km
35. 8.412 mm = 0.008412 m
36. 68.2 mg = 0.0682 g
37. 8.5743 cm = 0.000085743 km
38. 95,870 m = 95870000 mm
39. 547 kl = 547000000 ml
40. 1 km = 1000000 mm

WS 1.6 Dimensional Analysis (CONVERSIONS)

This may be the most important worksheet of the semester.

1 ft = 12 in
1 mi = 5280 ft
1 lb = 16 oz
1 gal = 4 qt
1 in = 2.54 cm
1 mi = 1.61 km
1 lb = 454 g
1 L = 1.057 qt
1 m = 100 cm
1 km = 1000 m
1 kg = 1000 g
1 L = 1000 mL
1 mL = 1 cm^3

example A: 29.5 in –> ft: $29.5\,\text{in} \times \frac{1\,\text{ft}}{12\,\text{in}} = 2.46\,\text{ft}$

example B: 0.036 m –> in: $0.036\,\text{m} \times \frac{100\,\text{cm}}{1\,\text{m}} \times \frac{1\,\text{in}}{2.54\,\text{cm}} = 1.4\,\text{in}$

1) 2.45 ft –> mi $2.45\,\text{ft} \times \frac{1\,\text{mi}}{5280\,\text{ft}} = 4.64 \times 10^{-4}\,\text{mi}$

2) 75.0 kg –> lb $75.0\,\text{kg} \times \frac{2.2\,\text{lb}}{1\,\text{kg}} = 165\,\text{lb}$

3) 10.0 gal –> mL $10.0\,\text{gal} \times \frac{4\,\text{qt}}{1\,\text{gal}} \times \frac{1\,\text{L}}{1.057\,\text{qt}} \times \frac{1000\,\text{mL}}{1\,\text{L}} = 9460\,\text{mL}$

4) 89 km –> in $89\,\text{km} \times \frac{1000\,\text{m}}{1\,\text{km}} \times \frac{100\,\text{cm}}{1\,\text{m}} \times \frac{1\,\text{in}}{2.54\,\text{cm}} = 3.5 \times 10^{6}\,\text{in}$

example C: 5.17 lb/gal –> lb/qt: $\frac{5.17\,\text{lb}}{1\,\text{gal}} \times \frac{1\,\text{gal}}{4\,\text{qt}} = 1.29\,\text{lb/qt}$

example D: 3.4 mi/hr –> km/min $\frac{3.4\,\text{mi}}{1\,\text{hr}} \times \frac{1.61\,\text{km}}{1\,\text{mi}} \times \frac{1\,\text{hr}}{60\,\text{min}} = 9.1 \times 10^{-2}\,\text{km/min}$

5) 459 ft/sec –> mi/hr $\frac{459\,\text{ft}}{1\,\text{sec}} \times \frac{1\,\text{mi}}{5280\,\text{ft}} \times \frac{60\,\text{sec}}{1\,\text{min}} \times \frac{60\,\text{min}}{1\,\text{hr}} = 313\,\text{ft/sec}$

6) 2.40 g/mL –> lb/gal $\frac{2.40\,\text{g}}{1\,\text{mL}} \times \frac{1\,\text{kg}}{1000\,\text{g}} \times \frac{2.2\,\text{lb}}{1\,\text{kg}} \times \frac{1000\,\text{mL}}{1\,\text{L}} \times \frac{1\,\text{L}}{1.057\,\text{qt}} \times \frac{4\,\text{qt}}{1\,\text{gal}} = 20.0\,\text{lb/gal}$

7) 32.56 km/hr –> ft/hr $\frac{32.56\,\text{km}}{1\,\text{hr}} \times \frac{1\,\text{mi}}{1.61\,\text{km}} \times \frac{5280\,\text{ft}}{1\,\text{mi}} = 106800\,\text{ft/hr}$

example E: 3.9 cm^3 –> ft^3 $3.9\,\text{cm}^3 \times \left(\frac{1\,\text{in}}{2.54\,\text{cm}}\right)^3 \times \left(\frac{1\,\text{ft}}{12\,\text{in}}\right)^3 = 1.4 \times 10^{-4}\,\text{ft}^3$

8) 5800 mi^2 –> km^2 $5800\,\text{mi}^2 \times \left(\frac{1.61\,\text{km}}{1\,\text{mi}}\right)^2 = 15000\,\text{km}^3$

9) 35.2 ft^2 –> cm^2 $35.2\,\text{ft}^2 \times \left(\frac{12\,\text{in}}{1\,\text{ft}}\right)^2 \left(\frac{2.54\,\text{cm}}{1\,\text{in}}\right)^2 = 30200\,\text{cm}^2$

ANS (IRO+2): 0.000464 165 107,000 22.4 32,700 15,000 313 220. 3,500,000 20.0 37,800

UNITS (IRO+2): km^2 mL lb/gal m ft/hr cm^2 in mi/hr lb kg lb/ft^3

Practice Problems

Factor Label Problem Solving

Name: _____

The following equalities might be necessary in some of the problems on this worksheet.

2.54 cm = 1.00 in
454 g = 1.00 lb
1.00 Angstrom (A°) = 1 x 10^{-8} cm
3 ft = 1 yard
12 inches = 1 ft

Please SHOW ALL WORK using the factor label method!!! Do not forget units!!!!

1. How many dimes are in 56 dollars? How many pennies? (ans. = 5600 pennies)

$\$56\left(\frac{10\text{ dimes}}{1\$}\right) = 560\text{ dime}\left(\frac{10\text{ pennies}}{1\text{ dime}}\right) = 5600\text{ pennies}.$

2. How many nickels are there in 6 quarters? (ans. = 30 nickels)

$6\text{ quarters}\left(\frac{5\text{ nickels}}{1\text{ quarter}}\right) = 30\text{ nickel}.$

3. How many hours, minutes and seconds are in 3 weeks? (ans. = 504 hrs, 30240 min, 1814400 sec)

$3\text{ wks}\left(\frac{7\text{ days}}{1\text{ wk}}\right)\left(\frac{24\text{ hrs}}{1\text{ day}}\right) = 504\text{ hrs}\left(\frac{60\text{ min}}{1\text{ hr}}\right) = 30240\text{ min}\left(\frac{60\text{ sec}}{1\text{ min}}\right) = 1814400\text{ sec}$

4. Convert 17 pounds to grams. (ans. = 7.7 x 10^3 g)

$17\text{ lb}\left(\frac{1\text{ kg}}{2.2\text{ lb}}\right)\left(\frac{1000\text{ g}}{1\text{ kg}}\right) = 7727.272727 \rightarrow 7.7 \times 10^3\text{ g}$

5. How many centimeters are in 254 inches? (ans. = 645 cm)

$254\text{ in}\left(\frac{2.54\text{ cm}}{1\text{ in}}\right) = 645.16 \rightarrow 645\text{ cm}$

6. 50.0 yards contain how many feet? (ans. = 150 ft)

$50.0\text{ yd}\left(\frac{3\text{ ft}}{1\text{ yd}}\right) = 150.\text{ ft or } 150 \times 10^2\text{ ft}.$

7. Convert 540 mm to kilometers. (ans. = 5.40 x 10^{-4} km)

$540\text{ mm}\left(\frac{1\text{ Km}}{1 \times 10^6\text{ mm}}\right) = 5.40 \times 10^{-4}\text{ Km}$

8. How many centimeters are there in 2.0 feet? (ans. = 61 cm)

$2.0\text{ ft}\left(\frac{12\text{ in}}{1\text{ ft}}\right)\left(\frac{2.54\text{ cm}}{1\text{ in}}\right) = 60.96 \rightarrow 61\text{ cm}$

9. Convert 150 feet to Angstroms. (ans. = 4.57 x 10^{11} A°)

$150\text{ ft}\left(\frac{12\text{ in}}{1\text{ ft}}\right)\left(\frac{2.54\text{ cm}}{1\text{ in}}\right)\left(\frac{1\text{ A}^\circ}{1 \times 10^{-8}\text{ cm}}\right) = 4.6 \times 10^{11}\text{ A}^\circ$